JOURNAL OF COASTAL AND HYDRAULIC STRUCTURES

Review and rebuttal of the paper

Numerical and small-scale physical modelling of wave transmission by wooden fences

Dao et al.

Editor handling the paper: Rebekka Kopmann

Subject: [JCHS] Editor Decision

Dear Tung Hoang Dao:

We have reached a decision regarding your submission to Journal of Coastal and Hydraulic Structures, "Numerical and small-scale physical modelling of wave transmission by wooden fences".

We decided to request revisions.

Please revise your paper considering all remarks of the reviewers carefully. Additionally, a table that includes each reviewer's remark and your concerning consideration is needed in an extra file. It should be sorted by reviewers.
Best regards,

Rebekka Kopmann
JCHS

Dear Rebekka Kopmann,

Thank you very much for handling our paper and sending us the reviewers' comments. The comments are very helpful to improve our papers.

We have addressed the reviewers' comments in separate responses to the reviewer in the following letter. The responses to the reviewers' comments are given in red font and the additional and/or modified text in the updated manuscript is also given in red font.

Thank you again for your time and effort.

Sincerely,

Hoang Tung Dao

Review round 1

Reviewer A:

Overview:

The manuscript presented here is a numerical and small-scale physical modelling study looking at wave interaction with fences similar to those in the Lower Mekong Delta. The manuscript is well written and very detailed providing a good rationalization for all the decisions made through the physical modelling process. Overall, I think the manuscript is worthy of publication, I only have a couple of comments that could be addressed.

Response: Thank you very much for your compliments.

Major:

I may have missed something but it is a little unclear as to the wave height and period outlined in Table 3 and Figure 7; are those measured values or those generated at the wavemaker?

Response: Indeed, it is unclear since we have not indicated the values of wave heights and period properly.

- In Table 3, the wave heights and periods are the target values imported in the wave generator. So, in the paragraph right before Table 3, we indicated a sentence "For each combination of peak period, depth and fence thickness, three scaled significant wave heights ($H_{s,m}$) varying from 0.03 m to 0.075 m were imported in wave generator at deep water (Figure 2)".
- In Section 3.1 (Validation results), the significant wave heights in paragraph right before Figure 7 are the measured values. We added a sentence at the new line 283-285: "Note that the observed wave heights at the measurement location were within 10% of the target values.".

Is there expected to be any influence on the scale effects if the lower frequency waves could be better resolved by the model? The authors mention that the model does not necessarily capture the low-frequency transmitted waves. Considering their importance for sediment transport processes, this seems like a useful addition to the discussion.

Response: From our study, the low-frequency transmitted waves from the SWASH model were hardly validated with the physical model because the complex flow resistance inside the inner parts influences the wave spectrum in the physical model. And, in the numerical model, the wave dissipation due to inner parts was based on the theoretical equation found in Suzuki et al. (2019). We believe that this is not related to what the reviewer mentioned. However, we added a sentence in the new line 315-316 to make this issue clearer: "Moreover, the low frequencies (<0.25 Hz) are not well resolved due to the limited duration of both the computation and the experiment, and contain little energy. Hence it is difficult to draw firm conclusions about it."

Additionally, it is understood that the low-frequency waves are essential for sediment transport processes, and the sediment transport processes through wooden fences will be studied in future research. We added sentences to the discussion section in the new lines 451 – 452: "Additionally, as the low frequency energy is slow, it has lower velocities and Reynolds' number. Therefore, the low frequency wave energy could be subject to scale effects due to extra (viscous) damping."

Minor:

Abstract: This sentence is a little convoluted, consider revising: "In the present study, a small-scale wave flume modelling of wave damping by a wooden fence was constructed

using the inner branches as an inhomogeneous arrangement tested in earlier flow-resistance experiments."

Response: Thank you. We revised and changed to "In the present study, a small-scale fence was tested in a wave flume to investigate the wave damping by wooden fences. The inner branches of the fence had the same inhomogeneous arrangement as tested in earlier flow-resistance experiments.".

Line 28: I think you mean that wave transmission decreases with thickness of fence.

Response: It is noted that we had made a misunderstanding in my writing. It should be wave damping instead of wave transmission. Therefore, we rewrote the sentence: "In the mentioned study, the wave damping increases with the increase of both wave nonlinearity, as indicated by the Ursell number and the fence thickness of wooden fences".

Line 34 – 54: It might help to make the comparison between vegetation and the fence earlier as the line between these paragraphs and the rest of the introduction is a little unclear as you move through.

Response: We added a sentence in new line 44 – 45 to indicate the similarity between wooden fence and vegetation: "Additionally, the description of flow and wave resistance of wooden fences and vegetation are comparable, as both are essentially caused by the drag force on an array of cylinders. From this perspective, the bulk drag coefficient, therefore, is an important parameter to characterize the flow and wave resistance by vegetation.".

Line 166: I may be misunderstanding, but I believe Hf should be 30 cm?

Response: Thank you for your correction. We fixed the Hf = 0.30 m.

Line 196: I am not really sure what this sentence is saying.

Response: It is unclear indeed, the sentence has been rewritten as: "Three fence thicknesses were used in the tests varying from 0.28 to 0.66 m, which were extended from a scaled value of Bm = 0.24 m (Table 2)".

Line 192 – 200: I find this paragraph a little challenging to understand, I am not sure how many tests were run, if they were repeated, where the cases with no inner parts are listed, etc.?

Response: Thank you for your comment, we have rewritten the paragraph as "Based on the small-scale wave conditions in Table 2, tests were performed for three shallow water depths (d_m) that varied from 0.15 m to 0.25 m. It should be noted that the wooden fence was tested only in an emerged condition due to the limited dimensions of the wave flume. Peak periods (T_p) from 1.1 s to 2.7 s were tested. For each water depth three fence thicknesses varying from 0.28 m to 0.66 m were tested (Table 4). The fence thicknesses were extended from a scaled value of B_m = 0.24 m (Table 2). This extension was aimed at testing the dependency of wave damping on fence thickness. For each combination of peak period, depth and fence thickness, three scaled significant wave heights ($H_{s,m}$) varying from 0.03 m to 0.075 m were imported in wave generator at deep water (Figure 2). As a result, there were a total of 27 tests performed in the wave flume. All tests were performed

with irregular waves using the JONSWAP spectrum with peak enhancement factor γ = 3.3. Wave conditions were named from Val.01 to Val.09, as presented in Table 3.”.

Recommendation: Accept Submission

Response: We have tried our best to address all your comments for the manuscript. Thank you very much for your time and effort to review our paper.

Reviewer B:

The importance of according close-to-nature measures in mangrove coast rehabilitation such as the bamboo fences is constantly increasing. In many places pilots of wooden fences have been applied - with more or less success. Adaptations of the design have been made based on experiences in the field. Although construction and adaptation of the design are practical tasks that only can be done in the field, a theoretical approach to find an optimized design is a very important challenge. Thus, the paper is very important for the field and provides a very good basis to improve the design of bamboo fences based on numerical modelling. It is properly organized and the approach is desribed in detail. The performance of the numerical modelling is explained and illustrated in length. It is recommended to check if some statements and figures in this section are redundant.

- Line 11: In the text describing figure 1 it is mentioned that "...the assembly consists of two lines of vertical bamboo poles...". The figure 1b shows a bamboo fence with 3 lines of vertical poles. This should be clarified.

Response: Thank you. We clarified the difference between Figure 1a and 1b by fixing the sentence in the paragraph right before: “The assembly consists of two (Figure 1a) to three (Figure 1b) lines of vertical bamboo poles, with forwarding-oriented poles that cover the horizontal branches of the inner parts...”. Because both of them were used in the field, the three lines fences were simply to extend the stability of fences. We assumed this is the main reason.

- Line 12: "...the horizontal branches of the inner parts..." - is this the same that is referred to as "brushwood bundels" in other publications? The structures of these "horizontal branches" should be described.

Response: Yes, it could be referred to as “brushwood bundles”. We fixed the mentioned sentence as “...the horizontal branches (brushwood bundles) of the inner parts...”.

- Line 102: The source of the drag coefficient formulas should be mentioned in the headline of table 1.

Response: We added the drag coefficient formulas sources: (Dao et al., 2020).

- Section 2.3 Physical model: A fence with three lines of vertical bamboo poles was used. This design is rarely applied. Please comment, why this setup has been chosen for the tests.

Response: We used this design because we would like to test the design closest to the existing wooden fences. We have indicated the use of this design more clearly above figure 1 (see our response three remarks earlier).

- Line 173: In the physical model PVC replaces bamboo. Does this have any effects on the wave dampening of the fence? Why was it applied instead of bamboo?

Response: The PVC poles in the physical model were used for several reasons. The PVC poles are very smooth so that the drag can be minimal and less effective on wave damping due to inner parts. The reason we did not use the bamboo poles because of the random character of these. In-store supplier, the bamboo diameter ranges from 1.8 to 2.5 cm; and, the bamboo poles are not entirely straight because of their joints. Thus, it might influence the measurements. To clarify this issue, we added a sentence in the paragraph right before Figure 4: “In this study, PVC piles with a diameter of 0.02 m were used as bamboo poles that scaled-down with a length scale of 5.0. The PVC piles are designed with a smooth surface and completely straight, leading to slightly less wave dissipation by these vertical poles than in the real situation, but conjectured to be closer to reality.”.

- Line 201 Table 3: Does this table provide informtion that is absolutely necessary?

Response: Thank you for your query but we are convinced that yes, it does. From our perspective, it provided information on wave characteristics for all tests in our study. Additionally, for each fence thickness and wave period, a certain wave height was input at the offshore position. It is challenging to reduce the information in this table. Therefore, we would like to keep this table without any changes.

- Section 3.1 Validation results: The numerical model shows very good accordance with the physical tests. This is shown at lentgh in this section. A reduction of this section would be possible without changing the key message.

Response: Thank you for your comments. We followed the actual contents necessary to provide a good comparison between numerical and physical models for validation result. We assume that this section was long because the figure and analysis were meant to support the validation results. And from our perspective, we would like to keep this section as it was in the first submission, and are hesitant removing content that the other reviewer appreciated.

- Figure 11: Is this information really necessary for the key message of the paper?

Response: Thank you for your comment but yes, we believe it is. From our perspective, even though the scale effects are minor compared to studies found in the literature, the scale differences might not be neglected. However, we considered the information should be at the discussion rather than in the main analysis. Therefore, we reproduced Figure 11 to the new Figure 13, and moved some parts of the analysis to the discussion to support Figure 13. The new discussion can be found in the new line 415 – 433.

- In the discussion a brief section about practical use of the results would be helpful: How can the results help to optimize the design? How can we optimize the horizontal branches of the inner part? What can be derived from the modelling regarding the design?

Response: Thank you very much for your comments. We added a paragraph from the new line 446-451 to indicate the future study, including the reviewer suggestions: “It is shown that the SWASH model is a suitable tool to evaluate the optimal configuration for the fence design. It could be used to show the function of the fence in more realistic 2D and 3D bathymetries. Moreover, it is indicated that the small-scale modelling can be applied for design with limited scale effects if wave height and small-scale branch diameter are larger than 0.15 m and 0.004 m, respectively. The results also highlight the more efficient wave damping when applying an inhomogeneous arrangement of brushwood inner parts.”

Recommendation: Revisions Required

Response: We have tried our best to address all your comments for the manuscript and we hope we have succeeded to convince you. Thank you very much for your time and effort to review our paper.